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ball of Saturn rotates as a solid body, and the ring as an assemblage of particles, each of which moves with a velocity determined by Kepler's third law, the expressions for the ball and for the planet are very different, the former being linear, and the latter an equation of a degree higher than the second. I have determined these expressions for the special case above mentioned. They are still further simplified by assuming that plane A also passes through the center of the planet.

Now, if we bring the image of Saturn, formed by a telescope, upon the slit of a spectroscope, with the slit in the intersecting plane A, the expressions above referred to are also the equations to the curves of which the lines in the spectrum of the planet are a part, referred to an undisplaced spectral line and the perpendicular line through its center as axes; for, in these curves, x is proportional to the perpendicular distance from plane B, and, by Doppler's principle, y is proportional to the velocity in the line of sight. The simplest case is, of course, that in which the slit coincides with the major axis of the ring; this is also the condition for which the differential velocity of points on the surface of the ring is a maximum, and it is one which can be approximately realized in observation.

Hence the laws of rotation of the component parts of the system can be determined (within certain limits) by the *form* of the special lines, and the form can be determined with very considerable accuracy by photographing the spectrum with a suitable instrument.

According to the assumptions which have been made above, and which represent the accepted hypothesis, lines in the spectrum of the ball are straight, but inclined; as compared with their direction the general inclination of the (theoretically) curved lines in the spectra of the opposite sides of the ring is smaller, and it is *reversed*. The

actual aspect of the lines on my photographs is in exact accordance with that required by the hypothesis.

If the ring rotated as a whole, the lines in its spectrum would be straight, and their direction would pass through the origin; they would be very nearly prolongations of the planetary lines. Such an aspect of the lines as this could be recognized on my photographs at a glance.

The direction of a line free from displacement was obtained by photographing the spectrum of the full moon on the same plate, on each side of the spectrum of Saturn.

For further details, with the numerical results of measurement of the plates, I must refer to the May number of the *Astrophysical Journal*, in which I have described these observations at some length.

JAMES E. KEELER.

ALLEGHENY OBSERVATORY.

A GENERAL SUBJECT-INDEX TO PERIODICAL SCIENTIFIC LITERATURE.

THE EDITOR OF SCIENCE—*My Dear Sir*: I notice that you are printing in SCIENCE various replies to the circular of the Royal Society of London relating to the matter of a general subject-index to all scientific publications. Your correspondents have so far been in favor of such an undertaking. As I do not believe it to be practicable, it may be of interest to some of your readers to see my own reply which I venture to send herewith. I have made a few trifling changes in the copy which I enclose.

I am, very respectfully,

EDWARD S. HOLDEN.

THE LICK OBSERVATORY,

March 30, 1895.

MOUNT HAMILTON, April 24, 1894.

TO PROFESSOR M. FOSTER, *Secretary R. S.*,

Chairman of the Committee on a Subject-Index, etc., etc.

My Dear Sir: I beg to acknowledge receipt of the circular of April 6 relating to a pro-

posed subject-index of scientific papers, and to express my opinions on some of the points contained therein. I will not burden you with the arguments that might be brought forward in support of the opinions, at this time; but, of course, I am very ready to give my reasons in detail should you desire them.

I. It appears to be of the utmost importance that the Royal Society should continue to issue its author-indexes, *i. e.*, the quarto Catalogues of Scientific Papers. Such indexes can be made at comparatively small expense, and by comparatively unskilled workers, under the direction of a single competent scientific head.

II. It is entirely otherwise with a subject-index. *Here the routine work must be done by the expert.* Professor Helmholtz was none too good to make the subject-index of his Optics. If it had been made by one of his pupils, it would have been less valuable; if it had been made by clerks, it would have been of little use except to beginners. It is perfectly clear that, in general, we cannot expect our bibliographies, etc., to be made by the heads of science, as Helmholtz, Houzeau, etc., and it therefore seems to me that it is unadvisable to attempt a general subject-index to science on any plan whatever.

III. If it is ever attempted at all, it should not, in my judgement, be done by international coöperation, but by a single society responsible only to itself. International coöperation has, I believe, generally failed (the only marked exceptions that I recall are the International Geodetic Association and the International Bureau of Weights and Measures). The Zone observations of the German Astronomical Society are of the highest use and excellence, but they were begun by international coöperation about 1866 and are not yet published.

IV. If the work is attempted, it should be printed in English alone, one would

think. If the past is not ours, the future surely is to be.

V. My own opinion, therefore, is that the general subject-index should not be attempted. The Royal Society and other great academies might well subsidize the making of special bibliographies, for example, Houzeau's *Bibliographie de l' Astronomie* (already printed), or Professor Cleveland Abbe's *Bibliography of the Literature of Meteorology* (now in MS.), and other undertakings of the kind, when they are directed by men of special learning, and not otherwise.

VI. It, however, appears to me that the Royal Society can do a great work in the direction aimed at, at comparatively little expense and trouble, as follows: I would, first, say that it is necessary—essential—that an author-index should be complete. It is very desirable, but by no means essential, that a subject-index should be exhaustive. A subject-index is generally required to set the inquirer on his way, and once fairly started in his reading, the foot-notes will keep him informed. This being granted, the plan I refer to is for the Royal Society to undertake the publication, in one volume, of a subject-index, or guide, to the ten quartos of author-indexes already prepared. The work could be easily done as follows: Select a scheme of subject-headings, under the advice of specialists. The Melville Dewey plan of library cataloguing* would serve as a basis, and it is capable of indefinite and logical subdivision. This subdivision should be made under the advice of the heads of English science; and, in my opinion, the thing to be avoided is too minute division. A practical point is, also, that the same paper should be catalogued under all the headings under which it might be sought, not merely under the strictly logical and appropriate heading.

* Which is based on the scheme of Dr. W. T. Harris, Editor of the *Journal of Speculative Philosophy*.

This is a detail, but it is of prime importance.

For each subject, as Astronomy, appoint a Director who should be the best man obtainable, but who may be any competent and faithful astronomer, even if he is without very wide experience and reading. Let each Director go over the author-indexes already in type, and mark each entry there printed with the numerals expressing its class or classes. Many, in fact most, of these papers can be pretty well classified from their titles alone, especially if the subject-index is not too minutely subdivided. All cases of doubt must be resolved by a reference to the original memoir. A clerk follows the Director. He finds under *Newcomb* certain papers which have been marked by the Director as relating to Astronomical Optics—Class XXXII., say. He, therefore, collects these on a card, thus:

XXXII.

Newcomb (S): Nos. 1, 11, 19, 26 (vol. I.).

In a subsequent volume he finds other entries belonging under class XXXII. and under *Newcomb*, and makes a separate card for them, noting the volume. The same thing is done by the Director for Astronomy for all his classes and for each author; and by the Directors of other subjects in like manner; and they are followed by copyists. Finally all cards are sorted into one series:

First, by the class—as XXXII.

Second, alphabetically by authors, and then revised and printed thus.

Class XXXII.—Astronomical Optics—Optics of the Telescope; see also classes XCV., etc., etc.

Abbe (C): Vol. i., 17, 34; ii., 80; ix., 92, etc.

Albrecht (T): Vol. vii., 13; viii., 31.

Auwers (A): ii., 7, 23; iii., 18, 37; iv., etc., etc., etc., etc.

By following out this plan under intelligent Directors for the special topics, the

Royal Society would very soon have a nearly complete subject-index in one volume, covering its author-indexes, vols. i.-x.; and the plan, once in operation, could be carried on without trouble and at small expense. Such a subject-index would, in my view, supply all real needs in science. It certainly would in my branch of it.

The only objection that I can see to this plan is that it is not perfectly complete and logical to the extremest point. If the preface to the proposed book declares that it is not intended to be so, it seems to me that the Royal Society need not mind. After the book was printed it would, I think, be used by everyone; and it would, I believe, meet the wants of every one as nearly as any practicable plan could do.

If I have extended my remarks too far, I beg you to excuse me. I have desired to show what seems to me to be an easily obtained benefit to science, and I trust my suggestion is not impertinent to your inquiry. I am, My Dear Sir, with high regard,

Very faithfully yours,

EDWARD S. HOLDEN.

SCIENTIFIC LITERATURE.

Ein Geologischer Querschnitt durch die Ost-Alpen, nebst Anhang über die sog. Glarner Doppelfalte von A. ROTHPLETZ, mit 2 Tafeln und 115 Abbildungen im Text. Stuttgart. 1894. Pp. 268.

This valuable contribution to our knowledge of mountain structure is arranged in three parts. The first of these is a statement of the petrography and stratigraphy, and the second an account of the tectonic, of a cross-section of the Alps, in the meridian of Munich, from the plain of the Po to the Bavarian plateau, a distance of about 230 km. The third part is a discussion of the general results of the author's study. The details of the first two parts are well illustrated, both by the fine geologically colored profile on a scale of $7\frac{1}{2}$ to 100, and by